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ABSTRACT

Fiscal Impact Budgeting Systems (FIBS) are sophisticated computer based modeling procedures used in local government organizations, whose results, however, are often overlooked or ignored by decision makers. A study attempted to discover the reasons for this situation by focusing on four factors: potential usefulness, faith in computers, production process knowledge, and input data accuracy. Subjects, approximately 100 officials and members of citizens' boards, responded to 30 Likert-type scale items covering the four factors and the dependent variable: output acceptance or rejection. Results indicated that only faith in computers was nonsignificant while perceived accuracy of input data made the most important contribution to perceptions of quality of output. These results imply that organizations should pay more attention to user involvement in implementation and knowledge adequacy. Decision makers must also become more aware of how the FIBS model works. (JL)

FACTORS AFFECTING UTILIZATION OF INFORMATION OUTPUT OF COMPUTER-BASED MODELING PROCEDURES IN LOCAL GOVERNMENT ORGANIZATIONS

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Introduction

Organizations, increasingly, are using computer technology for the generation, manipulation, storage and analysis of information upon which organizational performance depends. A case in point is local government, which uses computing to examine fiscal alternatives before making spending decisions. One of the most technologically advanced applications is a family of computer-based models known as Fiscal Impact Budgeting Systems (FIBS). These computer-based models permit simultaneous consideration of alternative revenue and spending scenarios, substantially increasing the number, complexity, and interdependence of calculations that are made as compared to manually performed fiscal analysis (Dutton & Kraemer, 1979). However, applications of FIBS fail to impact decision-making to the extent originally expected by modelers and users; results of FIBS analysis are ignored by users and vendors find a reluctance to implement by new users (Dutton & Kraemer, 1980). The present study attempts to discover some factors which may affect the utilization of results by local government users.

Information Utilization

A growing body of research centers on the acceptance or rejection of information for resource allocation, policy formation, planning and program management by governmental agencies (Weiss, 1979). Acceptance or rejection of information is viewed as the result of an evaluative process performed by receivers and is labeled as information utilization by Rich (1969) and Machlup (1979). Recent research suggests several criteria employed by receivers for evaluating items of information (Weiss & Bucuvalas, 1977, 1978; Weiss, 1979). In a series of case studies exploring the use of scientific research in mental health agencies, interview responses yield criteria of relevance,

research quality, conformity of content to expectations, action orientation, and challenge to the status quo (Weiss & Bucuvalas, 1978) and criteria of relevance and trust-worthiness of message content (Weiss, 1979).

These criteria reflect receiver concerns that senders may be distorting information in a manner consistent with sender distortion behaviors described by Campbell (1958). Campbell suggested that senders will not pass on information perceived as irrelevant, inaccurate, or unimportant; that they will add content to information perceived as incomplete or difficult to understand; and they will change information perceived as unbelievable, unrealistic or nonconforming to expectations. These categories of distortion behaviors are validated in research exploring message distortion in organizational contexts (Krivonos, 1976; author cite, 1980).

Viewing receivers of research information as occupying a middle position in a serial communication context, we expect them to evaluate incoming information according to the criteria suggested by Weiss and Bucuvalas (1978) and Weiss (1979) and then to perform as senders when the information is used for subsequent decision-making in a manner consistent with Campbell's (1958) description. In other words, incoming information will be evaluated for acceptance or rejection (utilized) and may be deleted, added to, or changed when input into the decision-making process (used). Weiss (1979) finds that information users claim to use specifically many of these criteria when evaluating information from social science research.

Factors Affecting Information Utilization

The previous discussion defines information utilization as an evaluation process engaged in by receivers. The criteria described reflect receiver perceptions of the message itself, such as the relevance of the content and the conformity of content to receiver expectations. The following discussion suggests situational/contextual factors which affect the application of evaluation criteria.

Potential Usefulness - Research suggests that receiver perceptions of potential usefulness of the information importantly affects the evaluation decision. Badura and

Waltz (1979), in a study of employees in German organizations, conclude that two major factors -- 1) personal attitudes toward the content and 2) organizational (contextual) attitudes toward the usefulness of the content -- affect the acceptance or rejection of information. Holzner and Fisher (1979) also argue that potential usefulness of content affects the acceptance/rejection decision.

Potential usefulness is viewed as a contextual variable because it goes beyond message content itself. (The criterion of relevance, described above as a component of the evaluation decision, refers to the internal consistency between items of information within a message and the overall message at hand.) Machlup (1979) argues for a distinction between the use of information as input in a decision-making process and utilization of information through the evaluation process to accept or reject.

Knowledge of the Data Production Process - It is suggested that the more the receiver knows about how the information was produced, the less the receiver is concerned with internal indicators of validity within the message itself (Mitroff, in progress). This is consistent with research on source credibility. For example, Lashbrook, Snavely & Sullivan (1977) suggest that high source credibility enhances the perceived informational value of messages. Anderson and Clevenger (1963) summarize their review of research on ethos (source credibility) as substantiating a consistent relationship between the ethos of the source and the impact of the message on receivers. Anderson (1971) suggests that the persuasive impact of a message is weighted by receiver perceptions of the source. Lumsden (1977) finds strong evidence that message impact is a multiplicative function of message strength and strength of the source's credibility.

The research on source credibility is concerned with information about the source which is possessed by receivers. That information includes both prior knowledge of the source and impressions formed during the experience of communication. In the case of information generated through computer-based models such as FIBS, the receivers do not necessarily focus on a specific human source -- indeed multiple sources are at

work, such as model designers, computer technicians and so forth. Knowledge of the process by which the information is generated seems a reasonable substitute for source credibility in this context. For example, the receiver's understanding or lack of understanding of how the FIBS model works allows that receiver to assess the competence of the process; source competence is a consistently validated factor of source credibility (Berlo, Lemert & Mertz, 1969; McCroskey, 1966; Markham, 1968; Whitehead, 1968).

Knowledge of the process by which information is generated appears to be antecedent to user involvement in computer-based technological applications. (User involvement reflects user influence on decisions affecting the design and implementation of technology and we presuppose some level of user knowledge as a necessary antecedent to the decision-making process.) User involvement is related to the acceptance or rejection of computer-based information systems (Kraemer, Dutton & Northrop, 1981). We may argue some support for a relationship between knowledge of the information generation process and the acceptance/rejection decision of the output of that process.

Perceived Accuracy of Input Data - The acceptance/rejection decision made by receivers is performed on a body of information we might call the output message. Serial communication processes (Campbell, 1958) suggest that the output message is composed of other information which precedes the output message and might be thought of as input data. Perceptions of the quality of the input data are expected to affect the valuation of the output message.

Research into attitude change and persuasion supports this relationship. Janis and Mann (1977) suggest that biases already held by receivers cause them to search for information in subsequent messages to support those biases. Karlins and Abelson (1970) state that "new [later] information contrary to an existing viewpoint tends to be distorted to fit the existing value structure [of the receiver]" (p.33). These

assertions are consistent with classic studies on selective exposure (Brock & Becker, 1965; Diab, 1962; Mills, 1965; Siebald, 1962). All of these studies suggest that subsequent messages are evaluated by receivers based on evaluations of prior input. We might assume, then, that receivers who perceive the input data as being accurate will carry over those attributions of accuracy to the output message. In the present case, the acceptance/rejection decision of the results of a FIBS model are hypothesized to be related to the perceived accuracy of the data upon which the analysis is based.

Faith in Computer Technology - Kraemer and Dutton (1979) suggest that blind faith in computing, unrelated to anticipated payoffs and unaffected by actual payoffs, is based on an affective reaction to the technology. Based on their findings, faith in the technology might explain subsequent evaluations of the output of the technology. Executives strongly believe that computers provide information which is useful in decision making and information they otherwise could not obtain (Dutton & Kraemer, 1978). We might expect their evaluations of computer output to be directly related to their attitude toward the technology itself.

Statement of the Problem

The present study examines factors affecting the evaluation, by receivers, of information output from FIBS leading to the acceptance/rejection (utilization) decision. Four factors are hypothesized to affect output evaluation: 1) potential usefulness of the output information, 2) user knowledge of the information production process, 3) perceived quality of input data and 4) user faith in computer technology in general.

METHODS

Research Variables

Five variables are operationalized as summated scales constructed from multiple items. The dependent variable, output acceptance or rejection, is defined as the perceived quality of output information. Participants are asked to respond to seven

bi-polar adjective pairs on seven-point semantic differential scales; adjective pairs are based on evaluation criteria generated by Weiss and Bucuvalas (1978) and similar to dimensions of message quality used by (author cite, 1980).

The potential usefulness of the output information assesses both the perceived potential usefulness of the computer-based model as an analytical process and the perceived potential usefulness of the output information. Potential usefulness of output information is assumed to be an underlying belief or perception taken into consideration when assessing the potential usefulness of computer-based models. This variable is measured on eight five-point Likert-type scales, ranging from strongly disagree (1) to strongly agree (5).

User knowledge of the information production process assesses the adequacy of information received by users regarding four aspects of the process: procedures of computerized fiscal impact analysis, how the model works, necessary input data for the analysis and procedures for interpreting results of the analysis. These are measured by four items employing four-point scales, ranging from very inadequate (1) to very adequate (4). The concept of information adequacy (perceptions of the amount of information need/desired relative to the amount of information received) has been validated extensively in the ICA communication audit (Goldhaber & Rogers, 1979).

Perceived accuracy of input data measures beliefs about the accuracy of the four kinds of data input into a FIBS model: cost of services, revenues, population and land use. Each input data category was rated on a seven-point semantic differential type scale ranging from inaccurate (1) to accurate (7). The use of accuracy as a valid measure of quality of input data is based on research regarding message distortion in organizations. Accuracy is viewed as the reciprocal of distortion and is considered a dominant concern of organizational members (Sussman & Krivonos, 1976).

Finally, faith in computer technology assesses users' beliefs about the use of computer technology in the work place. This is measured on four Likert-type scales with a five-point range, strongly disagree (1) to strongly agree (5). These items

are based on Kraemer and Dutton's (1979) measure of faith in computers.

Participants

One hundred thirty government users of FIBS represent a census of principle users at 20 local government sites where a FIBS model was bought or leased and implemented. The 20 sites represent all cities and counties where FIBS were actually used. Sites are identified through model vendors and specific users at each site are identified through telephone interviews.

Participants include elected or appointed officials in administrative, financial and planning functions and appointed members of citizen boards, commissions or advisory groups. Almost 90% of the respondents have at least one college-level degree. Almost all are at least somewhat interested in computing and have at least one year of experience with some form of fiscal impact analysis. Less than one-half of the respondents are involved in organizational decisions about which model to purchase nor how the model is to be used.

Procedures

The items used in this study are part of a larger survey. Questionnaire booklets are mailed to all identified users; they are self-administered with instructions included in the booklets. Participants are assured of anonymity and that only aggregate results will be reported. Completed booklets are returned by mail directly to the researchers. The response rate is 80% (n=110).

Data Analysis

Validity, reliability and colinearity - Following procedures suggested by Schriesheim and Bird (1980) and others, items comprising the scales measuring the five research variables are assessed for content validity (how accurately the questionnaire items fit their respectful theoretical construct definitions). Ten expert judges are asked to sort items into categories based on construct definitions.

Inclusion criteria are designed to isolate items that clearly loaded onto only one scale.

The scales are tested for internal consistency reliability using Cronbach's alpha, with a minimally-acceptable alpha level of .70 (Nunnally, 1978). Pearson product-moment correlations are performed to assess the degree of independence among the scales (Haitovsky, 1969). Significance for the resulting Chi-square statistic is set at $p < .001$.

Hypothesis Testing - A simple multiple regression analysis with simultaneous inclusion is performed to test the hypothesized relationship among the research variables. Multiple partial correlations are also computed to assess the incremental predictive power of each independent variable with all other independent variables held constant.

RESULTS

Validity, Reliability and Colinearity

The five variable scales are constructed based on the results of analysis of judges' category ratings. Three of the original 30 scale items are excluded from further analysis. The results for internal consistency reliability (Cronbach's alpha) and Pearson product-moment correlations among the scales are summarized in Table 1. The alpha levels for all scales exceed the minimally acceptable level of .70 (Nunnally, 1978), ranging from .74 to .94. A certain degree of colinearity is expected in multiple regression (Haitovsky, 1969) and Rockwell (1975) suggests a rule-of-thumb that independent variable correlations must exceed .80 to severely compromise the assumptions underlying multiple regression analysis. As shown in Table 1, the highest independent variable correlation is .62 and the results of the Haitovsky test (1969) and factor analysis of individual items do not suggest excessive multicolinearity.

INSERT TABLE 1 ABOUT HERE

Multiple Regression Analysis

Simultaneous inclusion - In the absence of theory indicating the order of importance among the independent variables, a simultaneous inclusion multiple regression analysis is performed on the data. The results are summarized in Table 2. The composite regression equation has an adjusted $R^2 = .58$ and is significant at the .01 level when all four are included; only faith in computers is not statistically significant.

INSERT TABLE 2 ABOUT HERE

Possible redundancy among independent variables - Cohen and Cohen (1975) suggest that possible redundancy among independent variables exists if a correlation between one independent variable and the dependent variable exceeds the product of the correlations between the other independent variable and the dependent variable and between the two independent variables. In the present study there is evidence of redundancy between two pairs of independent variables: 1) knowledge of the information production process and perceived accuracy of input data and 2) potential usefulness and perceived accuracy of input data. In order to obtain a truer picture of the relative unique contribution of each independent variable in the regression equation, multiple partial correlations are computed for each independent variable, removing the effects of the other three independent variables. The results show partial correlations of .35 for potential usefulness, .16 for faith in computers, .46 for input data accuracy and .34 production process knowledge.. Only the result for faith in computers is nonsignificant. These results suggest that perceived accuracy of input data makes the most important contribution, with relatively equal contributions from potential usefulness and from knowledge of the information production process. Faith in computers makes no significant contribution to explaining perceptions of quality of output. The pattern is similar to that obtained by examining the beta weights in the regression equation (Table 2).

DISCUSSION

The results tend to support the present research hypotheses in a manner consistent with previous research. For example, Mitroff's (in progress) work implies a positive relationship between both potential usefulness and information level about process and the acceptance or rejection information; this relationship is supported in the present extension of Mitroff's hypothesis. Further support can be derived from the work of Badura & Waltz (1979) and Holzner and Fisher (1979).

The present results are consistent with research in distortion. Potential usefulness is a measure of some aspect of content importance; the relationship between that variable and perceived quality of output is consistent with Campbell (1958). Similarly, perceived accuracy of input data affects perceived quality of output in a manner consistent with the distortion literature (e.g., Campbell, 1958; O'Reilly & Roberts, 1974; Read, 1962). The present study examines portions of the theory having impact on the acceptance or rejection of information (receivers' perceptions of distortion).

The present study fails to support a significant relationship between faith in computing and acceptance or rejection of information. Faith in computing is unrelated to anticipated benefits and unaffected by actual benefits (Kraemer & Dutton, 1979). It was thought that this affective response may predispose users in their response to output; however, the present findings suggest that perceptions of actual benefits are not affected by faith in computing. It seems likely that faith in computing is an affective response unrelated to the functioning of the technology itself.

Practical implications - The present study suggests that users of computing technology are positively affected by the amount of information they possess about what goes into the information production process, as well as by the potential usefulness of the process and its output. While this is consistent with common sense, there is substantial evidence that the implications of user involvement and information

adequacy are not considered routinely in organizations implementing communications technologies and computing (Kraemer, Dutton & Northrup, 1981). Executives and decision-makers continue to need to be reminded of the positive implications and impacts of user involvement in implementation and adequate knowledge about the new process via training. User training by vendors and consultants needs to go beyond technicians and technical expertise to include users of the output produced by data processing.

In the general domain of organizations communication, these results have importance for a variety of message topics. If senders believe the information is essential, message construction should emphasize the relationship between message content and the evaluation criteria. Individuals who do not perceive incoming messages as meeting their evaluation criteria are not likely to retain the content for future use; instead they are likely to reject the message as redundant noise. Since managers and executives often complain about the overload of incoming messages they experience, organizational senders must develop strategies to make important messages stand out. These findings suggest one possible strategy.

In the special case of FIBS, these findings suggest some reasons why the output of FIBS analysis have not been used by fiscal decision makers. First, decision makers may be wary of the FIBS model because they lack adequate knowledge of how the model works. Second, the potential usefulness of the FIBS modeling process may not be appreciated by decision makers, who are indirect users. Vendor attention probably concentrates on those local government officials responsible for purchasing or leasing the model and actually implementing it, while fiscal decision makers are more removed from these decisions. Third, the output information may fail to meet user evaluation criteria. Dutton and Kraemer (1979) suggest that FIBS models may be used to rationalize existing political positions rather than to indicate new political directions; thus dissonant data from the model may be rejected for use because it is not relevant to previously derived positions.

Research implications - The present study suggests that receiver evaluation criteria are consistent with receiver perceptions of message distortion. Krivonos (in press) suggests that organizational members are concerned with distortion (and its reciprocal, accuracy) of information for decision-making and control. (Author citation, 1981) validate the concept of receiver distortion as distinct from sender distortion in organizational settings. (Author citation, 1979) similarly explores the effects of receiver perceptions of distortion on organizational participants. This presents a fruitful area for further research because it implies that senders have only partial control over the quality of information circulating in organizations. Ultimately, it may be the receivers' perceptions of the quality of information, based on evaluation criteria affecting the acceptance/rejection decision, which control what information is included or excluded from the decision-making process. This warrants further empirical explication.

One interesting issue in assessing computer-produced information is the concept of source. The computer is largely a channel but it certainly has the capacity to re-form input data into output messages in a manner quite different from other channels which only encode or decode electronic impulses. Are modelers and/or programmers sources? Are those who compile and enter input data sources? This is a problematic issue that needs some illumination. The present study includes two variables that may relate to source credibility -- perceived accuracy of input data and knowledge of the information production process. For the present, these provide material for speculation, but further study is needed.

CONCLUSION

The present study suggests several contextual factors which are related to the acceptance or rejection of information by receivers. The particular context of FIBS analysis highlights an expensive, complex technological innovation that has been only marginally successful because the output information is often rejected by decision makers. An understanding of factors which affect the acceptance or rejection of output

information in this context can be useful for predicting the success or failure of other technological innovations. In addition, these factors can suggest communication strategies for all information sources, especially in organizational settings.

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TABLE 1: RELIABILITIES AND PEARSON PRODUCT-MOMENT CORRELATIONS AMONG SCALES* (n=110)

	1	2	3	4	5
1. Potential Usefulness	74				
2. Faith in Computers	27***	86			
3. Input Data Accuracy	44**	12	83		
4. Production Process Knowledge	62**	26***	62**	94	
5. Quality of Output	48**	10	36**	55**	93

*Diagonal elements are reliabilities using Cronbach's alpha. All decimal points have been dropped.

**p < .001
***p < .002

TABLE 2: MULTIPLE REGRESSION
(SIMULTANEOUS INCLUSION)
SUMMARY TABLE (n=110)

	B	Beta	F_{BETA}
QUALITY OF OUTPUT with:			
Potential Usefulness	.44	.29	13.88*
Faith in Computers	.33	.11	2.60
Input Data Accuracy	.73	.38	27.53*
Production Process Knowledge	.80	.26	12.85*

Composite Equation

Adjusted R^2 = .58

$F_{composite}$ = 36.51*

*$p < .01$

Addendum

Explanation of "author" citations in text

1. Author cite, 1979

Komsky, S.H. Perceived downward message distortion in hierarchical organizations. Unpublished Masters thesis, California State University, Northridge, California, 1979.

2. Author cite, 1981

Komsky, S.H., and Fulk, J. A multi-role approach to perceptions of message distortion. Paper presented to the Academy of Management, San Diego, California, 1981.

3. Author cite, 1980

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